

# PATENT ABSTRACTS OF JAPAN

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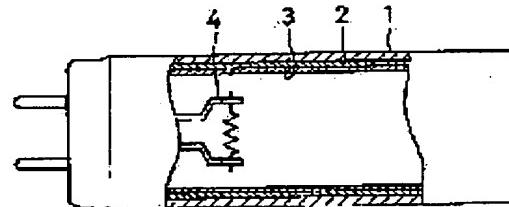
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## (54) FLUORESCENT LAMP

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To improve an appearance characteristic and the afterglow characteristic while preventing fall of a film of a luminescent layer by forming a first luminescent layer at a glass bulb side out of a phosphor containing boron and having the long afterglow characteristic, and forming a second luminescent layer on the discharge side out of a general lighting phosphor, and specifying the range of the quantity of adhesion of the first luminescent layer.

**SOLUTION:** A fluorescent layer 2 of a phosphor having a long afterglow characteristic expressed with a following chemical composition formula is formed in the inner surface of a glass bulb 1 in a range of quantity of adhesion at  $0.2\text{--}8.0 \text{ mg/cm}^2$ .  $(M^{1-p-q}E^{p}Q^{q})O_n(A^{1-m}B^{m})_2O_3$  where,  $0.0001 \leq p \leq 0.5$ ,  $0.0001 \leq q \leq 0.5$ ,  $0.5 \leq n \leq 3.0$ ,  $0.0001 \leq m \leq 0.5$ ,  $0.0001 \leq p+q \leq 0.75$ . In the formula, M is at least one kind to selected from a group of bivalent metals Mg, Ca, Sr, Ba and Zn, and Q is an additional active agent to be selected from a group Mn, Zr, Nb, Pr, Nd, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu. High adhering strength of the phosphor to the glass bulb 1 is thereby obtained.



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## CLAIMS

## [Claim(s)]

[Claim 1] In the fluorescent lamp which has the 1st and 2nd luminous layer which becomes the inside of a glass bulb from one sort or two sorts or more of fluorescent substances With the fluorescent substance which has the high-persistence which shows the 1st luminous layer by the side of said glass bulb by the following chemical composition formula, the 2nd luminous layer by the side of discharge is formed with the fluorescent substance for general lighting, and it is the coating weight of the 1st luminous layer 1cm<sup>2</sup> Fluorescent lamp characterized by setting it as the range of 0.2~8.0mg of hits.

(M1-P-q EuP Qa) O-n (aluminum1-m Bm) 203 — here, 0.0001 <=p<=0.50.0001 <=q<=0.50.5  
<=n<=3.00.0001 <=m<=0.50.0001 <=p+q<=0.75.0.5 — however It is at least one sort chosen from the group which M in an empirical formula is at least one sort chosen from the group of the divalent metal which consists of Mg, calcium, Sr, Ba, and Zn, and Q becomes from Mn, Zr, Nb, Pr, Nd, Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu by co-activating agent.

[Claim 2] In the fluorescent lamp which has the 1st and 2nd luminous layer which becomes the inside of a glass bulb from one sort or two sorts or more of fluorescent substances With the fluorescent substance which has the high-persistence which shows the 1st luminous layer by the side of said glass bulb by the following chemical composition formula, the 2nd luminous layer by the side of discharge is formed with the fluorescent substance for general lighting, and it is the coating weight of the 1st luminous layer 1cm<sup>2</sup> Fluorescent lamp characterized by setting it as the range of 0.2~8.0mg of hits.

(calcium1-P-q+r EuP Ndq Mn) O-n (aluminum1-m Bm) 203 and kP 206 — here — 0.0001 <= -p<=0.50.0005 <=q<=0.50.0005 <=r<=0.70.0001 <=p+q+r<=0.750.5 <=n<=3.00.0001 <=m<=0.50  
<=k<=0.21 </> / p<=20 — [Claim 3] The fluorescent lamp according to claim 1 or 2 characterized by having set the mean particle diameter of the fluorescent substance which has said high-persistence as the range of 5~15 micrometers, and setting particle size distribution as the range of 3~50 micrometers, respectively.

[Claim 4] The fluorescent lamp according to claim 1 or 2 characterized by forming said 2nd luminous layer in one sort or two sorts or more of phosphors using rare earth elements.

[Claim 5] The fluorescent lamp according to claim 1 or 2 characterized by forming the ultraviolet-rays reflecting layer which consists of an alumina or a magnesia between said glass bulb and 1st luminous layer.

[Claim 6] The fluorescent lamp according to claim 1 or 2 characterized by forming the conductive film of transluency between said glass bulb and 1st luminous layer.

[Claim 7] The fluorescent lamp according to claim 1 or 2 characterized by covering the peripheral face of said glass bulb in the protective layer of transluency.

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## DETAILED DESCRIPTION

## [Detailed Description of the Invention]

[0001]

[Field of the Invention] About a fluorescent lamp, even if it passes 10 minutes or more after [of especially this invention] lamp putting out lights, it relates to amelioration of the fluorescent lamp which presents the afterglow which can identify an object.

[0002]

[Description of the Prior Art] Generally, the fluorescent lamp for lighting forms the luminous layer which becomes the inside of for example, a glass bulb from a halo phosphate fluorescent substance, a phosphor using rare earth elements, etc., and is constituted.

[0003] For example, in the fluorescent lamp of the 40W type of straight pipes which used the halo phosphate fluorescent substance, the brightness of 2700~3100 (lm) is obtained and office is used in the large field like the large-sized store, the theater, the bathroom, and the underground center from the first.

[0004] Even when the electric current is cut off according to disaster, such as a fire and an earthquake, in the large-sized store in which many men gather especially, a theater, an underground center, etc., it is necessary to consider a human life to the first meaning and to evacuate it safely and quickly.

[0005] Therefore, it is obliged to install a guide light, an emergency light, etc. in the large-sized store which fills conditions, like have a tooth space more than fixed, and many men gather with Fire Service Law and the Building Standard Law, a theater, and an underground center other than a general lighting instrument.

[0006] These guide lights and an emergency light make a fluorescent lamp for example, always [forward] turn on by the source power supply, and by using a built-in dc-battery as a power source, they are constituted in an emergency (at the time of interruption of service) so that an illuminance may be more than 1 (Lx) and a fluorescent lamp thru/or an electric bulb, etc. may be turned on to 20 to 30 minutes or more.

[0007] For this reason, even if a source power supply should fail for power and a general lighting instrument etc. should put out the light in an emergency, since more than 1 (Lx) is secured also at the lowest, insurance and quick refuge of the illuminance of a floor line are attained.

[0008] However, since these guide lights and an emergency light are expensive, there is few the installation as compared with a general lighting instrument. For example, if crowded when arranged under the wall surface like an illuminated exit route light, in a person far from the man near a wall surface, a significant difference will arise in the visibility of an illuminated exit route light, and effect will appear also in the quick nature of refuge.

[0009] At the ordinary homes which, on the other hand, do not have the installation duty of such a guide light and an emergency light, when the electric current is cut off according to disaster, it may be [rather than it is easy] in refuge of a child and an old man to take refuge smoothly [in being pitch-black] and quickly.

[0010]

[Problem(s) to be Solved by the Invention] Therefore, these people set to the fluorescent lamp which has previously the 1st and 2nd luminous layer which becomes the inside of a glass bulb

[0017] Invention of the 5th of this invention is characterized by forming the ultraviolet-rays reflecting layer which consists of an alumina or a magnesia between said glass bulb and 1st luminous layer. Furthermore, the 6th invention it is characterized by forming the conductive film of translucency between said glass bulb and 1st luminous layer, and 7th invention is further characterized by covering the peripheral face of said glass bulb in the protective layer of translucency.

[0018]

[Embodiment of the Invention] Next, the 1st example of this invention is explained with reference to drawing 1. In this drawing, 1 is a glass bulb and the 1st luminous layer 2 is formed with the fluorescent substance (the 1st fluorescent substance is called hereafter) which presents the high-persistence shown by the following chemical composition formula to the inside.  
 $O-n \cdot 203.0001 = p < 0.50.0001 = q < 0.50.5 (\text{aluminum}-1-m \text{Bm}) (M1-P-q EuP Qq) < n < 30.0001$   
 $< m < 0.50.0001 < p < 0.75 -$  however it is at least one sort chosen from the group which M in an empirical formula is at least one sort chosen from the group of the divalent metal which consists of Mg, calcium, Sr, Ba, and Zn, and Q becomes from Mn, Zr, Nb, Pr, Nd, Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu by co-activating agent.

[0019] Moreover, this 1st luminous layer 2 can also consist of fluorescent substances (the 2nd fluorescent substance is called hereafter) which present the high-persistence shown by the following chemical composition formula.  
 $(\text{calcium}1-P-q EuP Ndg Mnr) O-n (\text{aluminum}-1-m \text{Bm}) 203 \text{ and } Kp 206 -$  here  $- 0.0001 < - p < 0.50.00005 < q < 0.50.00005 < r < 0.70.0001. < p + q + r < 0.750.5 < n < 3.00.0001 < m < 0.50$   
 $< k < 0.21 < r / p < 20,$  especially the coating weight of the 1st or 2nd fluorescent substance is 2 1cm. It is set as the range of 0.2~8.0mg of hits. The mean particle diameter by FSS (Fischer subsize sizer) of this fluorescent substance is set as the range of 5~15 micrometers, and particle size distribution are set as the range of 3~50 micrometers, respectively.

[0020] The laminating of the 2nd luminous layer 3 which consists of one sort or two sorts or more of fluorescent substances is carried out to this 1st luminous layer 2. This 2nd luminous layer 3 mixes one sort, such as phosphors using rare earth elements (Y2O3:Eu, LaPO4:Ce/Tb, 5 (Sr,Ca,Ba,Mg) 3 (PO4) 2 CeU, etc.), the fluorescent substances, for example, the halo phosphate fluorescent substances, for general lighting (calcium10(PO4) 6 FCl:Sb/Mn etc.), or two sorts or more, and is formed. In forming these luminous layers 2 and 3, the whole thickness can be equalized in comparison by setting up the spreading direction of the fluorescent substance coating liquid at the time of forming the 2nd luminous layer 3 contrary to the spreading direction of the fluorescent substance coating liquid at the time of forming the 1st luminous layer 2. In addition, 4 is an electrode arranged to the both ends of the glass bulb 1.

[0021] Since boron is contained in the 1st fluorescent substance which constitutes the 1st luminous layer 2 according to this example, even if a mechanical impact etc. is given in a production process by the ability improving the covering reinforcement to the glass bulb 1 of a fluorescent substance, \*\*\* of the 1st luminous layer 2 can be controlled and an appearance property and the decay characteristic can be improved not to mention improvement in the rate of an excellent article.

[0022] If the 1st luminous layer 2 is especially constituted from the 2nd fluorescent substance, since boron and a phosphoric acid are contained in this fluorescent substance, it not only can prevent \*\*\* certainly, but affinity with the glass bulb 1 of the 2nd fluorescent substance improves, and it can increase an afterglow illuminance sharply by improvement in heat resistance.

[0023] And since particle size distribution are set as the range which is 3~50 micrometers, respectively in the range the mean particle diameter of whose is 5~15 micrometers, the 1st or 2nd fluorescent substance can prevent \*\*\* of a luminous layer 2 effectively conjointly with use of an above-mentioned fluorescent substance. However, if mean particle diameter is set to less than 5 micrometers, an afterglow illuminance will become small, and if it exceeds 15 micrometers conversely, generating of \*\*\* will come to increase. Moreover, in particle size distribution, if a less than 3-micrometer size is contained for the minimum grain size, an afterglow illuminance will become small, and conversely, if that to which the maximum grain size exceeds 50

from one sort or two sorts or more of fluorescent substances. About the 1st luminous layer by the side of said glass bulb, a general formula is MA1 204. With the compound expressed M makes a mother crystal the compound which consists of one or more metallic elements chosen from the group which consists of calcium (calcium), strontium (Sr), and barium (Ba). With the fluorescent substance which has the high-persistence which used europium (Eu) as an activator The 2nd luminous layer by the side of discharge is formed with the fluorescent substance for general lighting, such as a phosphor using rare earth elements and a halo phosphate fluorescent substance, and it is the coating weight of the 1st luminous layer 1cm 2 The fluorescent lamp set as 0.2mg or more of hits was proposed (refer to JP.9-55191A).

[0011] According to this proposal, even if it goes through quite long time amount after putting out lights of this fluorescent lamp by using this fluorescent lamp like the common fluorescent lamp for lighting, the illuminance which can identify an object is obtained and the guide light-function and the function like a night-light at the time of interruption of service are done so.

[0012] However, in that production process, \*\*\* occurs no less than 7% in a luminous layer by a mechanical vibration given to a glass bulb, an impact, etc., the appearance property after completion is not only spoiled remarkably, but the rate of an excellent article also falls and this fluorescent lamp has the problem that it is difficult to maintain the grace of a product highly.

[0013] Moreover, the fluorescent substance which has the high-persistence which constitutes the 1st above-mentioned luminous layer is in the inclination to be easy to deteriorate at the baking process in the production process of a fluorescent lamp, and a fluorescent lamp with which a much more big afterglow illuminance is obtained from the decay characteristic after product completion being spoiled is desired.

[0014] So, the purpose of this invention is to offer the fluorescent lamp which can also improve an appearance property and the decay characteristic, when \*\*\* of a luminous layer can be prevented by constituting a luminous layer from a fluorescent substance which has the high-persistence which contains boron at least.

[0015]

[Means for Solving the Problem] Therefore, this invention is set to the fluorescent lamp which has the 1st and 2nd luminous layer which becomes the inside of a glass bulb from one sort or two sorts or more of fluorescent substances, in order to attain the above-mentioned purpose. With the fluorescent substance which has the high-persistence which shows the 1st luminous layer by the side of said glass bulb by the following chemical composition formula, the 2nd luminous layer by the side of discharge is formed with the fluorescent substance for general lighting, and it is the coating weight of the 1st luminous layer 1cm 2 It is characterized by setting it as the range of 0.2~8.0mg of hits.

$(M1-P-q EuP Qq) O-n (\text{aluminum}-1-m \text{Bm}) 203 -$  here  $0.0001 < p < 0.50.0001 < q < 0.50.5$   
 $< m < 3.00.0001 < n < 50.0001 < p + q < 0.75 -$  however it is at least one sort chosen from the group which M in an empirical formula is at least one sort chosen from the group of the divalent metal which consists of Mg, calcium, Sr, Ba, and Zn, and Q becomes from Mn, Zr, Nb, Pr, Nd, Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu by co-activating agent.

[0016] Moreover, invention of the 2nd of this invention is set to the fluorescent lamp which has the 1st and 2nd luminous layer which becomes the inside of a glass bulb from one sort or two sorts or more of fluorescent substances. With the fluorescent substance which has the high-persistence which shows the 1st luminous layer by the side of said glass bulb by the following chemical composition formula, the 2nd luminous layer by the side of discharge is formed with the fluorescent substance for general lighting, and it is the coating weight of the 1st luminous layer 1cm 2 It is characterized by setting it as the range of 0.2~8.0mg of hits.

$(\text{calcium}1-P-q-r EuP Ndg Mnr) O-n (\text{aluminum}-1-m \text{Bm}) 203 \text{ and } Kp 206 -$  here  $- 0.0001 < - p < 0.50.00005 < q < 0.50.00005 < r < 0.70.0001. < p + q + r < 0.750.5 < n < 3.00.0001 < m < 0.50$   
 $< k < 0.21 < r / p < 20$  and invention of the 3rd of this invention the mean particle diameter of the fluorescent substance which has said high-persistence in the range of 5~15 micrometers It is characterized by setting particle size distribution as the range of 3~50 micrometers, respectively, and 4th invention is characterized by forming said 2nd luminous layer in one sort or two sorts or more of phosphors using rare earth elements.

micrometers is contained, generating of \*\*\* will come to increase. Therefore, as for mean particle diameter and particle size distribution, it is desirable to set it as above-mentioned within the limits.

[0024] Moreover, since it consists of fluorescent substances which were formed in the inside of the glass bulb 1 in the state of the laminating and which are used for the fluorescent lamp for common lighting like a phosphor using rare earth elements in the 2nd luminous layer 3 of the discharge road side among the 1st and 2nd luminous layer 2 and 3 at least, it is efficiently excited by ultraviolet rays, such as 253.7 etc.nm, at the time of lamp lighting, and brightness can be made to increase sharply.

[0025] For moreover and the 1st luminous layer 2, it is formed in the glass bulb side, and the coating weight of that is 2 1cm. Since it is set as the range which is 0.2~8.0mg of hits, the 1st or 2nd fluorescent substance will be efficiently excited by the ultraviolet rays which penetrate the 2nd luminous layer 3, and will emit light by them. On the other hand, the synchrotron orbital radiation of \*\*\* is directly emitted outside from the glass bulb 1 at the time of putting out lights. Therefore, the synchrotron orbital radiation from the 1st luminous layer 2 can be made to be able to emit outside, without carrying out \*\*\* attenuation, can raise an afterglow illuminance, and can use it effectively also as induction light, such as an emergency.

[0026] Drawing 2 shows the 2nd example of this invention, and the ultraviolet-rays reflecting layer 5 which has transluency is formed between the glass bulb 1 and the 1st luminous layer 2. Mean particle diameter is desirable 0.1 micrometers or less, and this ultraviolet-rays reflecting layer 5 is formed with the alumina (alumina 203) of 30~50mm, the magnesia (MgO), etc. By the way, although the 1st and 2nd luminous layer 2 and 3 is excited by ultraviolet rays produced by discharge between electrodes 4, such as 253.7 etc.nm, and the fluorescent substance located in a discharge road side is excited efficiently, the excitation efficiency of the fluorescent substance located in the glass bulb side which keeps away from a discharge way tends to fall a little. However, since the ultraviolet rays which penetrated the 1st and 2nd luminous layer 2 and 3 are reflected by the ultraviolet-rays reflecting layer 5 according to this example, the fluorescent substance located in a glass bulb side will be excited by the ultraviolet rays and the reflected ultraviolet rays at the time of transparency. Therefore, luminous efficiency can be raised.

[0027] Moreover, discoloration by sown RARIZE-SHON can be prevented thru/or reduced by the relation which can control the contact to the glass bulb 1 of mercury by forming the ultraviolet-rays reflecting layer 5 by the alumina, for example.

[0028] Drawing 3 shows the 3rd example of this invention, and the conductive film 6 which has transluency is formed between the glass bulb 1 and the 1st luminous layer 2. This conductive film 6 is formed by spraying the solution which contains chlorination tin in the inside of the glass bulb of for example, a heating condition. This coat 6 has about [1~1000Kohm] resistance.

[0029] According to this example, it can apply to lighting fitting equipped with the lighting circuit apparatus of a rapid start type, and carries out suitable to use in the place which wants to save the time and effort of maintenance like a large-sized store, a theater, and an underground center.

[0030] If the ultraviolet-rays reflecting layer 5 shown in drawing 2 is especially formed between the glass bulb 1 and a conductive film 6, the discoloration produced when mercury contacts the tin of a coat 6 etc. can be prevented thru/or reduced not to mention an improvement of brightness. Therefore, the appearance condition as a fluorescent lamp can be improved.

[0031] Drawing 4 shows the 4th example of this invention, and the protective layer 7 is formed in the peripheral face of the glass bulb 1. This protective layer 7 consists of resin material, such as polyethylene terephthalate (PET), and thickness is set as 100~150 micrometers. It is made to heat and contract at 150~200 degrees C, and this protective layer 7 is formed by making it stick to the peripheral face of the glass bulb 1, after being beforehand constituted in the shape of a tube and inserting the glass bulb 1 in the interior of this. If ultraviolet absorption material, such as titanium oxide (TiO2), is made to mix in a protective layer 7 especially, the lightfastness of a protective layer 7 is not only improvable, but it will act as an ultraviolet-rays prevention layer. In addition, this configuration is applicable also to the fluorescent lamp shown in drawing 2 or

drawing 3.

[0032] According to this example, since the protective layers 7, such as a product made of resin, are formed in the peripheral face of the glass bulb 1, even if the glass bulb 1 should be damaged in an emergency, the illuminance of extent which it not only can prevent scattering, but can identify an object in the condition of having damaged is obtained. Therefore, smooth and quick refuge is attained.

[0033] If this fluorescent lamp is moreover removed from lighting fitting, since it can use as a substitute of a flashlight, what demonstrates not only refuge induction but the power which plans in respect of being various and is not found is conjectured.

[0034] In addition, a fluorescent lamp can apply straight pipe form fluorescent lamps other than a 40W type to a circular fluorescent lamp, a compact fluorescent lamp, a compact self-ballasted fluorescent lamp, etc. from the first, for example, without this invention being restrained by only the above-mentioned example in any way.

[0035]

[Example] Next, the 1st example of an experiment is explained. First, while forming the 1st luminous layer by slushing into the inside of the bulb for floor line40 the fluorescent substance coating liquid containing the 2nd fluorescent substance whose mean particle diameter is 10 micrometers and whose particle size distribution are 5~35 micrometers, the 2nd luminous layer is formed on the 1st luminous layer by slushing into the bulb for floor line40 the fluorescent substance coating liquid containing three kinds of phosphors using rare earth elements which present luminescence to a three-wave region, in addition, the coating weight of the 1st luminous layer — 5.0 mg/cm<sup>2</sup> it was.

[0036] In the condition of having arranged the illuminometer at the point isolated 1m from the central part of this fluorescent lamp, continuation lighting of the fluorescent lamp was carried out for 15 minutes with rated voltage, and when transition of the afterglow illuminance when switching off a fluorescent lamp after that was measured, the result shown in drawing 5 was obtained.

[0037] The afterglow illuminance of the fluorescent lamp concerning this invention in 0.5 seconds improves after putting out lights sharply [the conventional fluorescent lamp which these people proposed previously] more than twice [about] so that more clearly than this drawing. Since the heat deterioration of the 2nd fluorescent substance in a baking process was eased, this is guessed.

[0038] Moreover, when it manufactured 100 starting this invention and conventional example fluorescent lamps at a time, respectively and the incidence rate of \*\*\*\* was measured, in elegance, it was 7% conventionally to having been 0.001% in this invention article.

[0039] Next, the 2nd example of an experiment is explained. In the 1st example of an experiment, when floor line40 fluorescent lamp to which the mean particle diameter of the 2nd fluorescent substance was changed to 3~20 micrometers was manufactured and the propriety of a \*\*\* situation and an afterglow illuminance was measured thru or observed, the result shown in drawing 6 was obtained. In addition, when carrying out natural fall of the 1g weight only once on a fluorescent lamp from height of 50cm, whether \*\*\* with a diameter of 1mm or more occurred performs measurement of \*\*\* to a luminous layer, and it is shown that x mark generated that \*\*\* with a diameter of 1mm or more did not generate O mark. Moreover, in the evaluation criteria of an afterglow illuminance, it is shown that, as for O mark, the improvement effect was accepted as compared with the conventional example and that, as for x mark, an improvement effect was not accepted.

[0040] In the range whose mean particle diameter is 3~15 micrometers, although generating of \*\*\* was not accepted, generating of \*\*\* with mean particle diameter remarkable in 20 micrometers is seen, and it is understood that the covering reinforcement to the glass bulb of a luminous layer is weak, so that more clearly than this drawing. On the other hand, although the improvement effect over the conventional example was accepted in the afterglow illuminance in the range whose mean particle diameter is 5~20 micrometers, mean particle diameter was not accepted by 3 micrometers. The mean particle diameter of the fluorescent substance which presents high-persistence from this result has the desirable range of 5~15 micrometers.

[0041]

[Effect of the Invention] As mentioned above, since the fluorescent substance which presents the high-persistence in which boron is contained at least to the 1st luminous layer by the side of a glass bulb is used according to this invention, even if it can improve the covering reinforcement to the glass bulb of this fluorescent substance and a mechanical impact etc. is given to a glass bulb at the time of a production process thru or use, \*\*\* of the 1st luminous layer can be controlled and an appearance property and the decay characteristic can be improved not to mention improvement in the rate of an excellent article.

[0042] If the 1st luminous layer is especially constituted from the 2nd fluorescent substance, since boron and a phosphoric acid are contained in this fluorescent substance, it not only can prevent \*\*\* certainty, but affinity with the glass bulb 1 of the 2nd fluorescent substance improves, and it can increase an afterglow illuminance sharply by improvement in heat resistance.

[0043] And since particle size distribution are set as the range which is 3~50 micrometers, respectively in the range the mean particle diameter of whose is 5~15 micrometers, the fluorescent substances which presents high-persistence can prevent \*\*\* of a luminous layer effectively conjointly with use of an above-mentioned fluorescent substance.

[0044] Furthermore, for the 1st luminous layer, it is formed in the glass bulb side, and the coating weight of that is 2 1cm. Since it is set as the range which is 0.2~8.0mg of hits, the 1st luminous layer will be efficiently excited by the ultraviolet rays which penetrate the 2nd luminous layer, and will emit light by them. On the other hand, the synchrotron orbital radiation of \*\*\*\*\* is directly emitted outside from a glass bulb at the time of putting out lights. Therefore, the synchrotron orbital radiation from the 1st luminous layer can be made to be able to emit outside, without carrying out \*\*\*\*\* attenuation, can raise an afterglow illuminance, and can use it effectively also as induction light, such as an emergency.

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## DESCRIPTION OF DRAWINGS

## [Brief Description of the Drawings]

[Drawing\_1] The important section sectional view showing the 1st example of this invention.

[Drawing\_2] The important section sectional view showing the 2nd example of this invention.

[Drawing\_3] The important section sectional view showing the 3rd example of this invention.

[Drawing\_4] The important section sectional view showing the 4th example of this invention.

[Drawing\_5] Drawing showing the afterglow illuminance to the elapsed time after putting out lights.

[Drawing\_6] Drawing showing the relation between \*\*\* to the mean particle diameter of the fluorescent substance which constitutes the 1st luminous layer, and an afterglow illuminance.

## [Description of Notations]

- 1 Glass Bulb
- 2 1st Luminous Layer
- 3 2nd Luminous Layer
- 5 Ultraviolet-Rays Reflecting Layer
- 6 Conductive Film
- 7 Protective Layer

[Translation done.]